

CLAIMS

What is Claimed is:

1. A thermal bubble membrane actuator for ejecting a liquid comprising:

a base substrate of a semi-conducting material;

a first plurality of heating elements formed on said base substrate;

a first plurality of electrodes each in electrical communication with one of said first plurality of heating elements;

a first plurality of chambers formed in a first thick film photoresist layer with one of said first plurality of chambers formed on top of each of said first plurality of heating elements;

a membrane on top of said first thick film photoresist layer sealing a top of each of said plurality of chambers;

a liquid flow channel formed in a second thick film photoresist layer on top of said membrane;

a top substrate sealing a top of said liquid flow chamber; and

a liquid inlet and liquid outlet formed in said top substrate each in fluid communication with said liquid flow channel.

2. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said base substrate is a silicon substrate.

3. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said first plurality is three.

4. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said first plurality of chambers is three chambers with one chamber positioned juxtaposed to said liquid inlet and another chamber positioned juxtaposed to said liquid outlet.

5. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said membrane is formed of a material having an elasticity of at least that of silicon rubber.

6. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said membrane sealing a top of said plurality of chambers forming a plurality of hermitically sealed chambers.

7. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said membrane is formed of a material selected from the group consisting of rubber, PDMS, and polyparylene.

8. A thermal bubble membrane actuator for ejecting a liquid according to claim 1, wherein said first plurality of heating elements is formed of a material selected from the group consisting of TaAl, AfBz, Pt, AuCr and polysilicon.

9. A thermal bubble membrane actuator for ejecting a liquid according to claim 3, wherein a middle chamber in said three chambers cooperating with a middle heating element functions as an anti-back flow valve.

10. A method for fabricating a thermal bubble membrane actuator comprising the steps of:

providing a base substrate of a semi-conducting material;
depositing a layer of high electrical resistance material
on top of said base substrate;

forming a first plurality of heating elements from said
layer of high electrical resistance material;

depositing a layer of high electrical conductance material on said first plurality of heating elements;

forming a first plurality of electrodes from said layer of high electrical conductance material each in electrical communication with one of said first plurality of heating elements;

laminating a first thick film photoresist layer on top of said first plurality of electrodes and said first plurality of heating elements;

forming a first plurality of chambers with one on top of each of said plurality of heating elements in said first thick film photoresist layer;

laminating a membrane on top of said first plurality of chambers sealing a top of each of said plurality of chambers;

laminating a second thick film photoresist layer on top of said membrane;

forming a liquid flow channel in said second thick film photoresist layer;

laminating a top substrate onto and sealing a top of said liquid flow channel; and

forming a liquid inlet and a liquid outlet in said top substrate each in fluid communication with said liquid flow channel.

11. A method for fabricating a thermal bubble membrane actuator according to claim 10, further comprising the step of providing said base substrate in a silicon substrate.

12. A method for fabricating a thermal bubble membrane actuator according to claim 10, further comprising the step of selecting said high electrical resistance material from the group consisting of TaAl, AfBz, Pt, AuCr and polysilicon.

13. A method for fabricating a thermal bubble membrane actuator according to claim 10, further comprising the step of selecting a material for said membrane from the group consisting of silicon rubber, PDMS and polyparylene.

14. A method for fabricating a thermal bubble membrane actuator according to claim 10, further comprising the step of forming said first plurality of chambers in air-tight chambers.